CLAIMS

What I claim is:

1. A disposable coupon for evaluation of thermal characteristics of fuels in a fuel testing machine, the coupon comprising:

a central portion that provides a substrate onto which partially oxidized fuel degradation products are deposited; and

a burnished surface finish on the central portion that facilitates visual inspection and rating of the fuel degradation product deposits.

2. The disposable coupon of claim 1, in which the central portion comprises an alloy of aluminum.

3. The disposable coupon of claim 1, in which the central portion comprises a 6061-T6 alloy of aluminum.

4. The disposable coupon of claim 1, in which the coupon comprises a seamless, substantially cylindrical tube formed of the group consisting of aluminum, steel, brass, and titanium.

5. The disposable coupon of claim 1, in which the burnished surface finish is consistent and uniform across the central portion.

6. The disposable coupon of claim 1, in which the burnished surface finish comprises a substantially uniform pattern of microscopic ridges and valleys.

7. The disposable coupon of claim 6, in which the median depth between the microscopic ridges and valleys on the burnished surface finish does not exceed 500 nanometers.

8. The disposable coupon of claim 6, in which the median depth between the microscopic ridges and valleys on the burnished surface finish does not exceed 100 nanometers.

9. The disposable coupon of claim 6, in which the median depth between the microscopic ridges and valleys on the burnished surface finish does not exceed 20 nanometers.

10. The disposable coupon of claim 6, in which the median depth between the microscopic ridges and valleys on the burnished surface finish does not exceed 10 nanometers.

11. The disposable coupon of claim 1, in which the burnished surface finish is flat enough to cause incident coherent light to substantially maintain its coherence when it reflects off the burnished surface finish.

12. The disposable coupon of claim 1, in which the burnished surface finish is flat enough to facilitate substantially accurate measurements and calculations of fuel deposit thicknesses using an ellipsometric tube analyzer.

13. The disposable coupon of claim 1, in which the burnished surface finish provides the central portion with a bright, smooth, and highly reflective appearance.

14. The disposable coupon of claim 1, further comprising a surface that is work hardened.

15. A coupon for evaluating thermal characteristics of combustible hydrocarbons comprising:

a metallic central portion that provides a substrate onto which partially oxidized hydrocarbon degradation products are deposited; and

a substantially unscratched surface finish on the central portion of the coupon that facilitates visual inspection and rating of the hydrocarbon degradation deposits.

16. The coupon of claim 15, in which the surface finish comprises a pattern of microscopic ridges and valleys having a median depth that does not exceed 500 nanometers.

17. The coupon of claim 15, in which the surface finish comprises a pattern of microscopic ridges and valleys having a median depth that does not exceed 100 nanometers.

18. The coupon of claim 15, in which the surface finish comprises a pattern of microscopic ridges and valleys having a median depth that does not exceed 20 nanometers.

19. The coupon of claim 15, in which the surface finish comprises a pattern of microscopic ridges and valleys having a median depth that does not exceed 10 nanometers.

20. The coupon of claim 15, in which the surface finish is flat enough to cause incident coherent light to substantially maintain its coherence when it reflects off the surface finish.

21. The coupon of claim 15, in which the surface finish is flat enough to facilitate substantially accurate measurements and calculations of hydrocarbon deposit thicknesses using an ellipsometric tube analyzer.

22. A coupon for evaluating thermal characteristics of fuels comprising:

a metallic central portion that provides a substrate onto which partially oxidized fuel degradation products are deposited; and

a surface finish on the central portion of the coupon that is flat enough to cause incident coherent light to substantially maintain its coherence when it reflects off the surface finish.

23. The coupon of claim 22, in which the coupon comprises a seamless aluminum alloy tube having a reduced diameter at the central portion.

24. A coupon for evaluating thermal characteristics of fuels comprising:

a metallic central portion that provides a substrate onto which partially oxidized fuel degradation products are deposited; and

a work-hardened surface finish on the central portion of the coupon that facilitates visual inspection and rating of the fuel degradation product deposits.

25. The coupon of claim 24, in which the coupon comprises a seamless aluminum alloy tube having a reduced diameter at the central portion.

26. A coupon for evaluating thermal characteristics of fuels comprising:

a metallic central portion that provides a substrate onto which partially oxidized fuel degradation products are deposited;

a surface that is originally characterized by microscopic ridges and valleys; and

a finish on the surface of the central portion of the coupon in which the microscopic ridges are substantially smeared into the microscopic valleys of the coupon.

27. The coupon of claim 26, in which the coupon comprises a seamless aluminum alloy tube having a reduced diameter at the central portion.

28. A process for making a disposable metallic coupon to test the thermal characteristics of a fuel in a fuel testing machine, the process comprising:

providing a cylindrical metallic piece having an outer surface; and

burnishing the outer surface of a central portion of the metallic piece to provide a bright and highly reflective surface finish.

29. A disposable metallic coupon formed by the process of claim 28.

30. The process of claim 28, further comprising:

providing a burnishing machine having a plurality of equally-spaced tapered rollers that roll around and bear against an inversely tapered inside surface of a rotating mandrel;

inserting the metallic piece between the tapered rollers inside the rotating mandrel; and

drawing the tapered rollers inwardly against the outer surface of the metallic piece to provide a steady rolling pressure against the outer surface of the metallic piece.

31. A disposable metallic coupon formed by the process of claim 30.

32. The process of claim 30, further comprising applying sufficient rolling pressure against the outer surface of the metallic piece to work harden the outer surface of the piece.

33. A disposable metallic coupon formed by the process of claim 32.

34. The process of claim 32, where the metallic piece is a hollow tube having a diameter and two end portions, the process further comprising:

reducing the diameter of the central portion of the hollow tube; and

burnishing the end portions of the tube.

35. A disposable heater tube formed by the process of claim 34.

36. The process of claim 34, further comprising connecting an inverter to the burnishing machine, the burnishing machine having a minimum operating rotational speed, to reduce the minimum operating rotational speed of the burnishing machine.

37. A process for making a metallic coupon to test the thermal characteristics of a fuel in a fuel testing machine, the process comprising:

providing a cylindrical metallic piece having an outer surface; and

work-hardening the outer surface of a central portion of the metallic piece to provide a bright and highly reflective surface finish.

38. A process for making a metallic coupon to test the thermal characteristics of a fuel in a fuel testing machine, the process comprising:

providing a cylindrical metallic piece having an outer surface, the outer surface being originally characterized by microscopic ridges and valleys; and

displacing the microscopic ridges into the microscopic valleys of the outer surface of a central portion of the metallic piece to provide a bright and highly reflective surface finish.

39. A process for making a metallic coupon to test the thermal characteristics of a fuel in a fuel testing machine, the process comprising:

means for forming a cylindrical metallic piece having an outer surface; and

means for finishing the outer surface of a central portion of the metallic piece to provide a bright and highly reflective surface finish.

40. A method of testing the thermal characteristics of a fuel, the method comprising:

providing a metallic coupon having a burnished surface;

heating the metallic coupon to a temperature sufficient to cause partial oxidation of fuel coming into contact with the burnished surface;

passing pressurized fuel around the burnished surface of the coupon for a sufficient length of time to permit deposits of fuel degradation products onto the burnished surface, where the fuel degradation products are caused by the partial oxidation of the fuel under high heat and pressure conditions; and

evaluating the fuel degradation deposits on the burnished surface to test the thermal characteristics of the fuel.

41. The method of claim 40, further comprising cleaning the burnished surface before heating the metallic coupon.

42. The method of claim 40, where the metallic coupon comprises a hollow elongated tube.

43. The method of claim 40, where the action of evaluating the fuel degradation deposits comprises measuring the depth of the deposits with a machine.

44. The method of claim 43, where the machine comprises an ellipsometric tube analyzer.

45. A method of testing the thermal characteristics of a fuel, the method comprising:

providing a metallic coupon having a work-hardened surface;

heating the metallic coupon to a temperature sufficient to cause partial oxidation of fuel coming into contact with the work-hardened surface;

passing pressurized fuel around the work-hardened surface of the coupon for a sufficient length of time to permit deposits of fuel degradation products onto the work-hardened surface, where the fuel degradation products are caused by the partial oxidation of the fuel under high heat and pressure conditions; and

evaluating the fuel degradation product deposits on the work-hardened surface to test the thermal characteristics of the fuel.

46. A method of testing the thermal characteristics of a fuel, the method comprising:

providing a metallic coupon having a surface originally characterized by microscopic ridges and valleys, the surface being finished by substantially smearing the microscopic ridges into the microscopic valleys of the surface;

heating the metallic coupon to a temperature sufficient to cause partial oxidation of fuel coming into contact with the surface;

passing pressurized fuel around the surface of the coupon for a sufficient length of time to permit deposits of fuel degradation products onto the surface, where the fuel degradation products are caused by the partial oxidation of the fuel under high heat and pressure conditions; and

evaluating the fuel degradation product deposits on the surface to test the thermal characteristics of the fuel.

47. A disposable coupon for evaluation of thermal characteristics of fuels in a fuel testing machine, comprising:

a seamless cylindrical metallic tube comprised of a 6061 alloy of aluminum, the tube having a reduced-diameter central portion that provides a substrate onto which partially oxidized fuel degradation products are deposited; and

a work-hardened, burnished surface finish on the central portion of the tube that facilitates visual inspection and rating of the fuel degradation product deposits, where the

burnished surface finish has a bright, smooth, and highly reflective appearance and is consistent and uniform across the central portion of the tube.

48. A process for making a finished heater tube for evaluation of thermal characteristics of fuels in a fuel testing machine, the process comprising:

providing a raw heater tube having a reduced-diameter central portion and an outer surface;

providing a burnishing machine having a plurality of equally-spaced tapered rollers that roll around and bear against an inversely tapered inside surface of a rotating mandrel;

inserting the raw heater tube between the tapered rollers inside the rotating mandrel;

drawing the tapered rollers inwardly against the outer surface of the raw heater tube to provide a steady rolling pressure against the outer surface of the raw heater tube; and

applying sufficient rolling pressure against the outer surface of the raw heater tube to work harden the outer surface of the raw heater tube.

49. A finished heater tube formed by the process of claim 48.